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| 08/941,466      | 09/30/97    | ZANDI                | A 74451.P024C       |

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EXAMINER

JOHNSON, T

ART UNIT PAPER NUMBER

2723

DATE MAILED: 04/27/99

*27*

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

# Office Action Summary

Application No.

02/941466

Applicant(s)

Zandi et al.

Examiner

T. Johnson

Group Art Unit

2723

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

## Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

## Status

☒ Responsive to communication(s) filed on 3/12/99

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

☒ Claim(s) 14-8, 12-13, & 15-43 ~~is~~ are pending in the application.

Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

☐ Claim(s) \_\_\_\_\_ is/are allowed.

☒ Claim(s) same as pending ~~is~~ are rejected.

☐ Claim(s) \_\_\_\_\_ is/are objected to.

☐ Claim(s) \_\_\_\_\_ are subject to restriction or election requirement.

## Application Papers

- ☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- ☐ The proposed drawing correction, filed on \_\_\_\_\_ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
  - ☐ All ☐ Some\* ☐ None of the CERTIFIED copies of the priority documents have been received.
  - ☐ received in Application No. (Series Code/Serial Number) \_\_\_\_\_
  - ☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

## Attachment(s)

- ☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_
- ☐ Interview Summary, PTO-413
- ☐ Notice of References Cited, PTO-892
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Other \_\_\_\_\_

Office Action Summary

### Part III Detailed Action

#### Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

2. Claims 1, 4-8, 12-13, 15-38, 41, and 43 are rejected under 35 U.S.C. 103 as being unpatentable over Shapiro, "Embedded Image Coding Using Zerotrees of Wavelet Coefficients", in view of Woods, "Subband Image Coding", and Ormsby et al., 5,455,874.

For claim 1, applying a reversible wavelet transform to the input data to produce a series of coefficients is provided by Shapiro in at least the abstract and section B in the left column on page 3446. Applying an overlapped transform is not explicitly provided by Shapiro, but is suggested, since the length can be greater than the number of filters, where Woods is used only to show that Shapiro does satisfy this definition. Note also that Shapiro refers to Woods at least twice - see page 3447. Shapiro provides for 9-tap quadrature mirror filters (QMFs) on page 3448, left column, lines 13-16, where the number of taps corresponds to the length of the filters, where Woods notes that QMFs may consist of one pair of filters in the first paragraph on page 102, and examples of two filters are shown in Fig. 3.2 and 3.3 on pages 105 and 106, and Woods also provides for various numbers of taps for QMF filters in section 4.6 on page 180, and for QMFs which "include a variety of filters with different ... filter lengths" in the first full paragraph on page 107. Woods also provides for 80-tap filters in a 16-band system (indicating 16 filters), which are noted on page 180 in the first paragraph of section 4.6. Shapiro can use the various different conventional and well known filters of Woods, since they both provide for QMF filters. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use these overlapped transforms as well, since they are used in a

subband system of which is used by Shapiro, because these filters have "good reconstruction properties", and because "it is often convenient to use one of the optimized FIR QMFs".

Compressing the series of coefficients into data representing a compressed version of the input data is provided by Shapiro in at least the first full paragraph in section III on page 3448.

Shapiro does not explicitly provide for context modeling bits of the coefficients based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band. But Shapiro does provide for a context model in the first and second paragraphs in section C on pages 3454-3455, which is based on at least coefficients in other frequency bands in at least Figs. 4 and 5 on page 3450, and in Fig. 7 on page 3453. It is possible that Shapiro also provides for neighboring coefficients in the same frequency band, since he uses anywhere from 2-4 symbols, but is not explicitly taught. Using neighboring coefficients in the same frequency band as a context for entropy coding is conventional and well known, and is provided by Ormsby et al. in at least the third full paragraph in c. 4, where they provide for a "neighboring block" "context", where the blocks have both the same frequency band and other frequency bands in c. 5, lines 27-40, and in the fifth full paragraph in c. 4. Shapiro can use the neighboring coefficients in the same frequency band as provided by Ormsby et al., assuming that they do not already. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the context model of Ormsby et al., since they use the refer to the same classic arithmetic coding reference of Witten et al. for adaptation in their systems - Ormsby et al. in the first full paragraph in c. 11, and Shapiro where cited above as reference "[31]", and because Ormsby et al. improve upon the Witten et al. implementation by using registers and shifts "in order to improve speed" in the third full paragraph in c. 12.

For claim 4, applying the overlapped reversible wavelet transform comprises applying to the input data a plurality of non-minimal length reversible filters comprised of a plurality of one-dimensional filters is provided by Shapiro in paragraph C on page 3447, lines 11-12, and in the description of Figs. 1-2 on page 3447, which provide for application of "separable" "vertical and horizontal filters" where horizontal and vertical refer to a separate single dimension, and Woods also provides for a plurality of one-dimensional filters on at least pages 103-104, where they

explicitly provide for "1-D" "filtering". The filters of Shapiro and Woods are non-minimal, since they are long filters.

For claim 5, an image is provided by Shapiro in at least the title, and in the caption for Fig. 1 on page 3447. An image is also provided by Woods in at least the title, and by Ormsby et al. in at least the title and abstract.

For claim 6, bit significance embedding on the series of coefficients is provided by Shapiro on at least page 3446 in the left column.

For claims 7, decompressing the losslessly compressed version of the input data into transformed signals and generating the reconstructed version of the original using an inverse reversible wavelet transform is at least obviously, if not inherently, provided by Shapiro, since they transform the image with the wavelet transform in "decomposition", and explicitly provide for a "decoder" for "reconstructions" in at least the first full paragraph in section A on page 3445, where it is well known that "reconstruction" requires the wavelet transform again to synthesize the subbands together, since otherwise, the image could not be reconstructed. The concept of lossless decompression and wavelets are provided by Shapiro in at least the abstract, and explicitly elsewhere. Woods also provides for the conventional arrangement of reversible subband transforms using QMFs in at least Figs. 3.1 - 3.3 on pages 104-106, provide for wavelets in at least the first full paragraph in section 4.6 on page 180, and where QMF wavelets are also provided by Shapiro where cited above. It would have been obvious to one having ordinary skill in the art at the time the invention was made that Shapiro uses the basic synthesis stage shown by Woods, since this is required to reconstruct the image.

For claim 8, see the rejection of at least claims 1 and 7. See also at least the second full paragraph in c. 13 of Ormsby et al., which provide for context modeling in the decoder, since this was provided by the encoder. Also, the same is at least obviously, if not inherently, provided by Shapiro, since they could not otherwise "reconstruct" the image, which Shapiro does provide for.

For claim 12, see the rejection of at least claims 1 and 8. Woods shows in at least Figs. 3.2 and 3.3, that a first and second pair of filters is used in conventional subband coding such as QMF coding and explicitly notes "reconstruction" on page 105 and filter pairs in the bottom of page 106.

For claim 13, see the rejection of at least claims 1 and 6. Shapiro discloses an embedded wavelet transform encoding system on at least page 3446, in the first four lines of section B in the left column. Shapiro also provides for ordering the coefficients and bit significance embedding of the coefficients in at least the third and fourth bulleted paragraphs of section B on page 3446. Shapiro provides for two different codings of first and second portions of the data by at least significance in Fig. 6, or also by at least the embeddings in section B on page 3454. Shapiro uses an adaptive context model as noted above for at least claim 1.

For claim 15, Shapiro provides for tree coding in at least the second bulleted paragraph under section B. on page 3446, and the title.

For claim 16, Shapiro provides for formatting the coefficients into sign-magnitude format on at least lines 12-18 of the second column on page 3453.

For claim 17, see the rejection of at least claim 13. Coding the bit streams into a single bit stream is provided by at least the first full paragraph of section C on page 3454. Single bit streams are also shown in at least Fig. 3.

For claim 18, see the rejection of at least claim 17, where the coding is entropy coding, and Shapiro also provides for entropy coding as conventional and well known in at least the paragraph bridging pages 3448-3449.

For claim 19, see the rejection of at least claim 15.

For claim 20, see the rejection of at least claim 13.

For claim 21, lossless compression is provided by Shapiro in at least the abstract, the third full paragraph in section A on page 3445, Fig. 3, and in section C on page 3454.

For claim 22, see the rejection of at least claim 1, and an entropy encoder is provided in at least section C on page 3454.

For claim 23, see the rejection of at least claim 22. See also Shapiro in the last bulleted paragraph under section B on page 3446 and in the last paragraph of section A on pages 3453 and 3454, where the coder runs sequentially and can be stopped and thus not receiving all coefficients.

For claim 24, encoding the significance map of the wavelet coefficients on page 3448 in section III of the left column provides for coding the data on a single pass, where the significance

map is part of the embedded coder, because it is used to provide an embedded code by ordering in importance as noted in the first few lines in the second column on page 3445. It is also noted that the "successive-approximation" which provides for two passes is evidently not necessary as noted in the first few lines in the left column on page 3453. Furthermore, although Shapiro provides for two passes in the successive-approximation coding, it is noted that on the first "dominant pass", that coding is provided, so that data is again coded in a single pass with the embedded coder.

For claim 25, the overlapped reversible wavelet transform of Shapiro probably comprises a nine, nine transform, since he refers to "the 9-tap symmetric quadrature mirror filters" in at least the first full paragraph on page 3448. Shapiro does not explicitly provide for a Two, Ten transform. Using different variations of filters is conventional and well known, and is provided by Woods on at least page 107 in the first full paragraph as noted above for at least claim 1, where it is obvious for Shapiro to use different filters. The Two, Ten transform is further obvious, since this specific filter is not critical to the Applicant's invention, because the Applicant recites "The use of a single fixed high-pass filter is not required" on page 30, line 1, with emphasis added. Thus, the filters of Shapiro and Woods provide for at least equivalents.

For claim 26, see the rejection of at least claim 25.

For claim 27, see the rejection of at least claim 25.

For claim 28, see the rejection of at least claim 25.

For claim 29, see the rejection of at least claim 25.

For claim 30, see the rejection of at least claim 25.

For claim 31, see the rejection of at least claims 4 and 25.

For claim 32, see the rejection of at least claim 8.

For claim 33, see the rejection of at least claim 4.

For claim 34, see the rejection of at least claims 4 and 7, where the filters are also used on the decoding side.

For claim 35, see the rejection of at least claim 4.

For claim 36, see the rejection of at least claim 4.

For claim 37, see the rejection of at least claim 4.

For claim 38, see the rejection of at least claim 4.

For claim 41, see the rejection of at least claim 1.

For claim 43, see the rejection of at least claim 1.

3. Claims 25-31, 41, and 43 are rejected under 35 U.S.C. 103 as being unpatentable over Shapiro, "Embedded Image Coding Using Zerotrees of Wavelet Coefficients", in view of Woods, "Subband Image Coding", and Ormsby et al., 5,455,874, as applied to claims 1, 4-8, 12-13, 15-38, 41, and 43 above, and further in view of either Hartung et al., 5,481,308, or Shinichi, JP406038193A.

For claim 25, as noted above in the rejection of claim 25 with respect to Shapiro, Shapiro does not explicitly provide for a Two, Ten transform, but this conventional and well known filter arrangement is provided by both Hartung et al. and Shinichi in at least the paragraph bridging cols. 2-3, and the abstract respectively. This arrangement can be used with the filters of Shapiro, since they all provide QMFs, and because Shinichi explicitly provides for wavelets. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the Two, Ten filters of either Hartung et al. or Shinichi, since Hartung et al. provide for these filters with "minimum delay" in the last full paragraph in c. 5, and for "minimizing quantization effects" in the last full paragraph in c. 14, and Shinichi provide for "enhancing the energy concentration" and "to prevent the production of mosquito noise". The QMFs of Hartung et al. in the paragraph bridging cols. 2-3, are the same as those of Woods cited on page 107.

For claim 26, see the rejection of at least claim 25.

For claim 27, see the rejection of at least claim 25.

For claim 28, see the rejection of at least claim 25.

For claim 29, see the rejection of at least claim 25.

For claim 30, see the rejection of at least claim 25.

For claim 31, see the rejection of at least claims 4 and 25.

For claim 41, see the rejection of at least claim 25.

For claim 43, see the rejection of at least claim 1.



4. Claims 39-40, and 42 are rejected under 35 U.S.C. 103 as being unpatentable over Shapiro, "Embedded Image Coding Using Zerotrees of Wavelet Coefficients", in view of Woods, "Subband Image Coding".

For claim 39, see the rejection of at least claims 1 and 25.

For claim 40, a context model is provided by at least Shapiro as noted above for at least claim 1, and a bit generator is also provided by Shapiro in at least the second paragraph of section C on page 3454.

For claim 42, see the rejection of at least claims 8 and 25.

5. Claims 39-40, and 42 are rejected under 35 U.S.C. 103 as being unpatentable over Shapiro, "Embedded Image Coding Using Zerotrees of Wavelet Coefficients", in view of Woods, "Subband Image Coding", and further in view of either Hartung et al., 5,481,308, or Shinichi, JP406038193A.

For claim 39, see the rejection of at least claims 1 and 25.

For claim 40, a context model is provided by at least Shapiro as noted above for at least claim 1, and a bit generator is also provided by Shapiro in at least the second paragraph of section C on page 3454.

For claim 42, see the rejection of at least claims 8 and 25.

#### **Response to Amendment**

6. The 112/2 rejection of claim 4 has been overcome by amendment.

7. Applicant's arguments filed March 12, 1999 have been fully considered but they are not persuasive.

The Applicant argues in the last full paragraph on page 3 and the paragraph bridging pages 3-4 of the amendment, with respect to claims 1, 4-8, 12-13, 15-38, 41, and 43, that none of the references provide for a reversible transform, and that it is not obvious to use the filters of Woods with Shapiro. The Examiner respectfully disagrees, since at least Shapiro provides for a reversible transform in at least the abstract and section IV. A. starting on page 3453. It is obvious to use the filters of Woods, since Shapiro cites Woods in reference to filters, and further discusses other types of filters.

The Applicant argues on pages 4-6 of the amendment, with respect to claim 1, that Shapiro does not provide for using neighboring coefficients in the same frequency band and known coefficients in other frequency bands; that Ormsby et al. do not provide for neighboring coefficients in context; that the zero tree coding may not provide for neighboring coefficients; and that it is not obvious to use Ormsby et al., since they provide for vector quantization. The Examiner respectfully disagrees, since Ormsby et al. are used to show that neighboring coefficients in the same frequency band are conventional and well known, and that the context of Shapiro is based on coefficients in other frequency bands. Since Shapiro provides for coefficients in context, it is obvious to use the concept of doing so in the same frequency band, as suggested by Ormsby et al., since these vectors directly correspond to the coefficients, and, as noted in the rejection above, both Ormsby et al. and Shapiro discuss the well known reference of Witten et al. Even though Shapiro provide for tree based coding, they still have neighboring coefficients. Lastly, since both Ormsby et al. and Shapiro use arithmetic coding, and because the advantages of the arithmetic coding of Ormsby et al. improve upon the Witten et al. reference already discussed by Shapiro.

The Applicant argues in the last full paragraph on page 6 of the amendment, with respect to claim 23, that Shapiro does not provide for producing the coded data as the coefficients are received. The Examiner respectfully disagrees, since Shapiro codes received data in most of the figures.

The Applicant argues on pages 6-7 of the amendment, with respect to claims 25-31, 41, and 43, that the prior art of record does not provide for a reversible 2-10 transform. The Examiner respectfully disagrees, since a reversible 2-10 transform are well within the level of one of ordinary skill and scope of at least Woods, who provides for a wide variety of filters. Furthermore, both Hartung et al. and Shinichi explicitly provide for this conventional and well known non-critical filter arrangement.

#### **Final**

8. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

#### Contact Information

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy M. Johnson whose telephone number is (703) 306-3096.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

The Group Art Unit FAX numbers are (703) 308-5397 and (703) 306-5406.

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